

Notes about colour displays observed in female specimens of *Tremoctopus* (Cephalopoda: Octopoda) and their taxonomic value

Lidia Orsi Relini

Dip. Te. Ris., Laboratori
di Biologia Marina
ed Ecologia Animale,
Università di Genova
Corso Europa 26, 16132
Genova, Italy,
largepel@unige.it

Abstract

The dorsal arms of egg carrying females of *Tremoctopus* spp. are characterized by autotomic properties finalized to the protection of the mass of embryos. In case of danger, distal segments of the arms with their large lateral web are detached; mimicking the presence of eggs, the web exhibits different patterns in *Tremoctopus violaceus* and in *Tremoctopus gracilis*. Such patterns may be used to distinguish the two species, in the same way as morphological characteristics of the hectocotylized arm of male are used for taxonomical purposes.

Riassunto

Nell'agosto 2002 una grande femmina di *Tremoctopus*, che recava i suoi embrioni sulle braccia, fu fotografata nelle acque di Ponza mentre esibiva una enorme coloratissima tela (membrana interbrachiale) con complessi disegni. Dopo lo studio della letteratura sui rari eventi simili documentati con immagini sia nel Mediterraneo, sia in acque più remote, la femmina fu riconosciuta come *Tremoctopus gracilis*, una specie indopacifica. Infatti i disegni della tela possono mostrare: a) in *T. violaceus*, grosse macchie rotonde con scarsi disegni di contorno; b) in *T. gracilis*, serie di chiazze che formano grappoli disposti trasversalmente rispetto all'asse longitudinale del braccio. La distinzione delle due specie consentiva di tracciare l'arrivo attraverso il canale di Suez sia dell'esemplare di Ponza, sia di reperti avvenuti in acque istriane fin dagli anni '30 dello scorso secolo. Questa nota presenta l'iconografia utilizzata per la classificazione, riportata in studi anteriori, e fotografie più recenti di individui di *T. gracilis*, ottenute in ambiente naturale di giorno e di notte, rispettivamente a Ponza e nel Mar Rosso. Le braccia dorsali delle femmine di *Tremoctopus*, con la tela che le circonda, formano un apparato difensivo, finalizzato non semplicemente alla protezione della femmina stessa, ma in modo specifico a quella del grappolo di embrioni. Le loro capacità di autotomia corrispondono a quelle del braccio ectocotilizzato del maschio dello stesso genere, mentre il disegno attira l'attenzione del potenziale predatore su un grappolo che si ingrandisce mentre si allontana.

Key words

Cephalopoda, *Tremoctopus gracilis*, *Tremoctopus violaceus*, adult female taxonomy, colour patterns.

Results and discussion

During August 2002 a large egg-carrying female of *Tremoctopus* sp. was observed and photographed in the coastal waters of Ponza island, in the Tyrrhenian Sea (Belluscio et al., 2003).

The specimen exhibited a remarkable series of vivid colours such as blue, red, violet, orange, etc., and the observers – researchers engaged in biological sampling – did not attempt to capture it, probably because they were satisfied with the wonderful sight they were documenting with their camera (Fig. 1).

Subsequently, on the basis of the available literature about similar observations on living specimens (Müller, 1852; Kramer, 1937; Voss & Williamson, 1972), the Ponza specimen was assigned to the species *Tremoctopus gracilis* (Orsi Relini et al., 2004). In fact the comparison of colour patterns and distinctive spots exhibited on the dorsal arms by egg-carrying females allowed me to recognize two types of display: one, figured by Delle Chiaie (1830) and described in detail by Müller (1852), on specimens caught in the harbour of Messina (Sicily) (here shown by the figure from Portmann (1952) on the basis of a Ligurian specimen, Fig. 2), consisting in a large

round spot, encircled by minor figures, was considered typical of *Tremoctopus violaceus*; another one, in form of transversal bunches of spots figured in a colour table by Voss & Williamson (1972) was considered typical of *T. gracilis* (Fig. 3).

The pattern observed by Kramer (1937) in some Adriatic specimens (Fig. 4) appeared similar to the latter type. So, in the same time, a new exotic species of Indopacific origin was listed among the cephalopods recently immigrated from the Red Sea (Salman et al., 1999; Salman & Katağan, 2002) and the arrival of this immigrant was traced back to 67 years earlier (Orsi Relini et al., 2004).

The aim of these brief notes is to show the pictures of the females colour patterns which, for editorial reasons, could not be documented in the previous paper (Orsi Relini et al., 2004); some comments on their possible taxonomic use are added.

In a recent taxonomic survey of the genus *Tremoctopus* Delle Chiaie, 1830 four species are listed (Mangold et al., 1996):

Tremoctopus violaceus Delle Chiaie, 1830, type locality: Mediterranean Sea;

Tremoctopus gracilis (Eydoux & Souleyet, 1852), type locality: 8°N 106°W (Pacific Ocean);



Fig. 1. The female *Tremoctopus* of Ponza in the photographic sequence by Conticelli and Pellicciari. Both colour changes and different extensions of the web can be appreciated; in the lower right corner the egg mass is visible.

Fig. 1. La femmina di *Tremoctopus* di Ponza nella sequenza fotografica di Conticelli e Pellicciari. Si possono apprezzare sia i cambi di colore sia l'estensione variabile della membrana interbranchiale; nell'angolo in basso a destra si vede la massa delle uova.

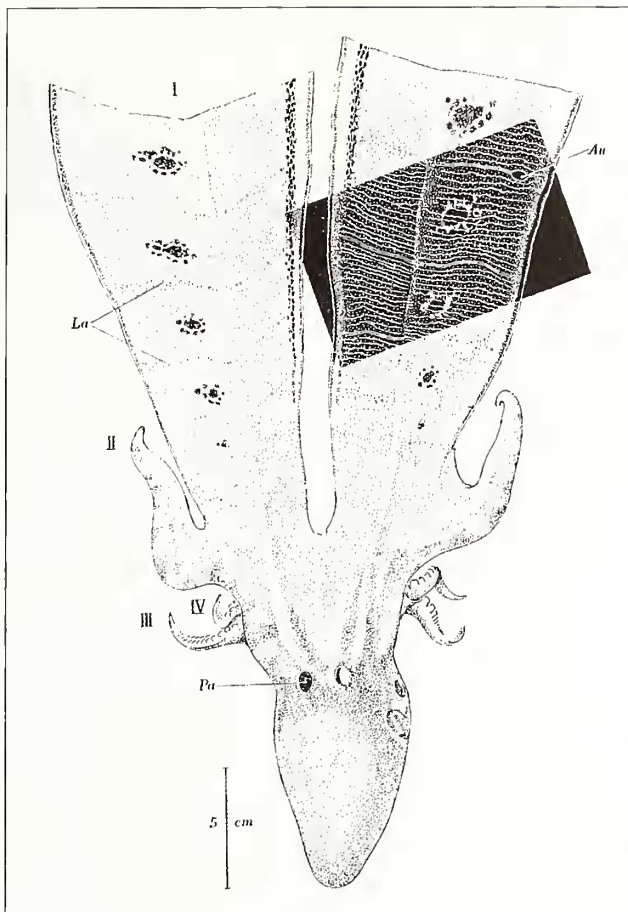


Fig. 2. *Tremoctopus violaceus* figured by Portmann (1952).

Fig. 2. *Tremoctopus violaceus* raffigurato da Portmann (1952).



Fig. 3. *Tremoctopus gracilis* figured by Voss & Williamson (1972) under the name *T. violaceus*.

Fig. 3. *Tremoctopus gracilis* raffigurato da Voss e Williamson (1972) col nome di *T. violaceus*.

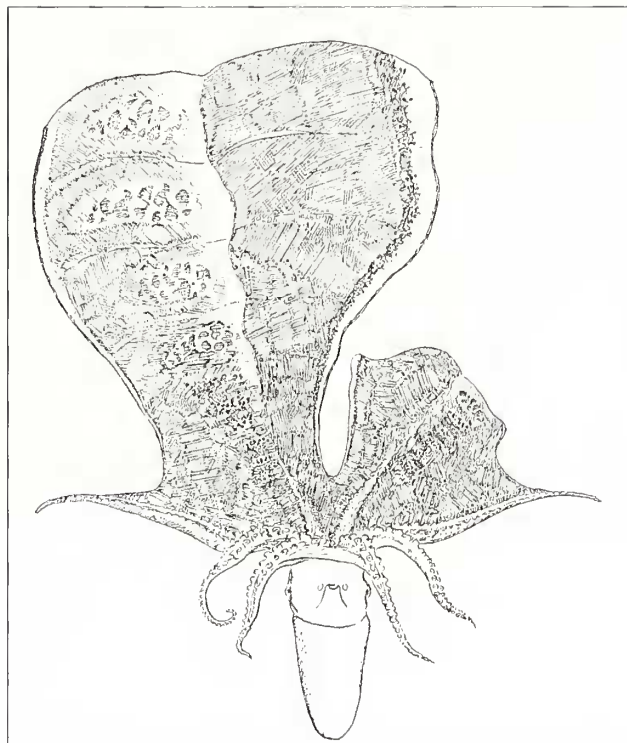


Fig. 4. *Tremoctopus gracilis* figured by Kramer (1937) under the name *T. violaceus*.

Fig. 4. *Tremoctopus gracilis* raffigurato da Kramer (1937) col nome di *T. violaceus*.

Tremoctopus gelatus Thomas, 1977, type locality: East Florida (Atlantic Ocean);

Tremoctopus robsoni Kirk, 1884 (or *T. robsonianus* as indicated by O'Shea, 1999, who resurrected the name by Kirk), type locality: New Zealand.

Tremoctopus gracilis, in the revision of the genus by Thomas (1977), was considered a subspecies of *T. violaceus*. Later on the separation of the two taxa in terms of species was possible on the basis of the structure of their hectocotylus (Mangold et al., 1996). The use of morphological patterns of the sexual apparatus for taxonomical purposes is of widespread use in several animal groups. In particular, in this genus of cephalopods, the counts of proximal and distal suckers of the hectocotylus are easily transformed into a key for species or subspecies identification (Thomas, 1977; Mangold et al., 1996).

On the contrary, females have been recognized by less precise criteria: those of *T. gelatus* are characterized, as well as in males, by gelatinous tissues (Thomas, 1977); those of *T. robsoni* have exceedingly long and convoluted distal oviducts (O'Shea, 1999); those of *T. violaceus* and *T. gracilis* are almost indistinguishable in their juvenile phase (Thomas, 1977). Nesis (1987) suggested that the chromatic pattern of the web surrounding the dorsal arms could be used to distinguish the two so similar forms (in his opinion, subspecies). The same author gave also evidence to the role of this web as a defensive tool, by means of the detachment of segments in the process of autotomy, which Kramer (1937) had previously described.

Nesis wrote (1987: p. 84): "Autotomy occurs along a predetermined line perpendicular to the axis of the arm.



Fig. 5. *Tremoctopus* sp. in a shot by Goud (1989) in the Red Sea.

Fig. 5. *Tremoctopus* sp. in una foto di Goud (1989) nel Mar Rosso.

The broken off portion has one sucker and one to three colored spots. Being deprived of nervous control, it instantly widens up to the size of a handkerchief, and the bright spots suddenly blazing before predator's eyes on the transparent membrane distract and probably frighten the enemy, thus allowing the female to flee".

It may be added that the spots or bunch of spots mimic the presence of eggs or groups of eggs. As a consequence, the coloration of the female dorsal arms are not an adaptation for the defence of the individual, as generally occurs in octopuses, but for the defence of the egg mass that the female is brooding at the base of the dorsal arms. The detached arm segment and its colour display can therefore be considered as the terminal expression of the female sexuality, as the hectocotylus, with its own autotomic capabilities, is the final expression of the male sexuality.

On such a basis, the use of egg-carrying female colour pattern as a taxonomic tool, albeit till now scarcely used so far, finds its justification.

In occasion of new records of adult females, in my opinion it is important to pay particular attention to their colour pattern. It is not excluded that the description of colours can be completed with notes on the distribution of bioluminescent tissues. In fact, an occasional nocturnal underwater record of *Tremoctopus "violaceus"* occurred in the Red Sea near Hurghada (Goud, 1989). The animal could be photographed thanks to its light display. The species concerned was probably *T. gracilis* (Fig. 5); however, as more and more pictures of *Tremoctopus* are stored in the internet, the complexity of morphological and chromatic patterns of this genus gains evidence as well as the paucity of the present taxonomical categories. New species seem to be waiting to be recognized.

Acknowledgements

I wish to thank M. Conticelli, C. Pellicciari, and J. Goud for the kind permission to use their underwater photographs in this paper.

I thank the Editor's work.

References

- BELLUSCIO A., ARDIZZONE G.D., CONTICELLI M. & PELLICCIARI C., 2003. Prima documentazione fotografica di una femmina ovigera di *Tremoctopus* sp. (Octopoda, Tremoctopodidae) nel Mediterraneo. *Biologia Marina Mediterranea*, **11** (2): 556-559.
- DELLE CHIAJE S., 1823-1831. Memorie sulla storia e notomia degli Animali senza vertebre del Regno di Napoli. Napoli, 4 volumes & atlas.
- GOUD J., 1989. Een bijzondere waarneming tijdens de Rode Zee-reis. Luminescentie bij *Tremoctopus violaceus*: een pelagische octopussoort. *Vita Marina*, Nov./Dec.: 75-78.
- KRAMER G., 1937. Einige Beobachtungen an *Tremoctopus violaceus*. *Note dell'Istituto Italo-Germanico di Biologia Marina di Rovigno*, **25**: 3-11.
- MANGOLD K.M., VECCHIONE M. & YOUNG R.E., 1996. Tremoctopodidae. *Tree of life Web Project*: <http://tolweb.org/Tremoctopodidae/20202>.
- MÜLLER H., 1852. Ueber das oberste Armpaar von *Tremoctopus*. *Verhandlungen der physik. Med. Gesellschaft Würzburg*, **3**.
- NESIS K., 1987. *Cephalopods of the world*. Neptune City, TFH Publications, 351 pp.
- ORSI RELINI L., BELLUSCIO A. & ARDIZZONE G.D., 2004. Tracking the Indopacific pelagic octopus *Tremoctopus gracilis* in the Mediterranean. *Rapports et procès verbaux de la Commission Internationale pour l'exploration scientifique de la Mer Méditerranée*, **37**: 415.
- O'SHEA S., 1999. The marine fauna of New Zealand: Octopoda (Mollusca: Cephalopoda). *NIWA Biodiversity Memoir*, **112**: 1-280.
- PORTMANN A., 1952. Les bras dorsaux de *Tremoctopus violaceus* Delle Chiaje. *Revue Suisse de Zoologie*, **59**: 288-293.
- SALMAN A., KATAGAN T. & BOLETZKY S.V., 1999. New cephalopod molluscs in the eastern Mediterranean: previously unnoted species or recent migrants? *Vie et Milieu*, **49**: 11-17.
- SALMAN A. & KATAĞAN T., 2002. Lessepsian immigrant cephalopods of the Mediterranean Sea. In Öztürk B. & Başausta N. (eds), *Workshop on Lessepsian Migration Proceedings*. Turkish Marine Research Foundation, **9**: 71-74.
- SWEENEY M.J., 2001. Current classification of recent Cephalopoda. Web page: <http://sirismm.si.edu/cephs/newclass.pdf>.
- THOMAS R.F., 1977. Systematics, distribution and biology of cephalopods of the genus *Tremoctopus* (Octopoda, Tremoctopodidae). *Bulletin of Marine science*, **27**: 353-392.
- VOSS G.L. & WILLIAMSON G.R., 1972. *Cephalopods of Hong Kong*. Hong Kong Government Press, Hong Kong.